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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

KERNS, KEVIN P

ART UNIT	PAPER NUMBER
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1725

DATE MAILED: 06/27/2002

19

Please find below and/or attached an Office communication concerning this application or proceeding.

MF=19

Office Action Summary

Application No.

09/372,636

Applicant(s)

HORNSCHEMEYER ET AL.

Examiner

Kevin P. Kerns

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 June 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7,9-12,14 and 15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7,9-12,14 and 15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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4. Claims 1, 6, 7, and 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grove et al. (US 5,927,378).

Grove et al. disclose a continuous casting mold assembly (funnel-shaped with billet-entrance side wider than billet-exit side) in which molten metal is shaped (formed) and cooled within the casting space, further containing a selective cooling structure to accommodate heat transfer inequality due to circulation patterns, which lead to mold deterioration, particularly in the meniscus region of the mold assembly (abstract; column 1, lines 60-63; column 2, lines 4-30; column 3, lines 12-27; and Figures 2 and 3). The mold assembly has a plurality of cooling slots (grooves), in which the area around the meniscus (thermally stressed area) contain slots machined to be deeper to produce an enhanced cooling effect at the area proximate to the meniscus, while producing a diminished cooling effect to other portions of the assembly (column 3, lines 28-67; column 4, lines 1-19; and Figures 2 and 3). The width, length, spacings relative to transition region III (stressed area), and/or depths of the slots (see slots 1-19 in Figure 2), as well as the residual thickness parameters would be varied (column 4, lines 20-53; and Figures 2 and 3). The variable wall thickness in the meniscus region (thermally stressed area of the broad-side wall) is reduced on the order of a few millimeters (column 4, lines 20-53; and Figures 2 and 3). Although Grove et al. do not teach a surface-related heat flow in the more stressed area of the bath surface that is specifically within the range of 5-40% (or 10-20%) greater than in the other areas of the bath surface, one of ordinary skill in the art would have recognized that the Grove et al. mold assembly, specifically in the stressed area around the meniscus, contains slots

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machined deeper to produce enhanced cooling in areas of the mold most susceptible to wear, in which such cooling parameters would be readily optimized by one of ordinary skill in the art. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

5. Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Villanueva et al. (US 5,797,444).

Villanueva et al. disclose an ingot mold (form-giving die of high heat conductivity) for continuous casting of metals in which its cooling-side surface has depressions, or cooling-optimized areas to constitute a region having elevated heat transfer coefficients (abstract; column 2, lines 3-8 and 20-28; and Figures 1 and 2). These regions of enhanced heat transfer, i.e. rate of heat flow, are generally located over the area(s) of the mold where optimized heat dissipation is desired, or relative to the other areas of the mold (column 1, lines 14-16 and 24-26; and column 2, lines 3-5, 20-24, 35-37, and 44-46). The cross-sectional area at the casting pour-in side is larger than that of the billet exit side (abstract; column 1, lines 5-10; and Figures 3, 4, and 8). Although Villanueva et al. do not teach a surface-related heat flow in the more stressed area of the bath surface that is specifically within the range of 5-40% (or 10-20%) greater than in the other areas of the bath surface, one of ordinary skill in the art would have recognized that the Villanueva et al. ingot mold, specifically in the abovementioned area(s) of the mold where optimized heat dissipation is desired (areas susceptible to the

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most mechanical and thermal wear), is capable of a range of cooling parameters in various mold cooling areas that would be readily optimized by one of ordinary skill in the art. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

6. Claims 1-5 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stagge et al. (WO97/43063). Note: for the Stagge et al. reference, page numbers and lines herein refer to the English translation of this German reference (provided in the prior office action of June 6, 2001). See the prior office action for the corresponding German pages/lines, if necessary.

Stagge et al. teach a liquid-cooled chill mold (casting die) with a form-giving casting die body (page 6, lines 2-8; and Figure 1), which is made of a material of high-heat conductivity, namely copper (page 3, lines 3-12; page 6, lines 17-19; and Figure 3). The cooling-surface side of the chill mold, comprised of a cooling zone with multiple cooling channels for greater heat flow dissipation, is oriented on the sides of the mold with the thermally and mechanically stressed areas of the mold (page 4, lines 2-26; page 5, lines 1-5; page 6, lines 24-26; and Figures 2-4). The liquid-cooled chill mold (casting die) includes a cavity that is composed of two broad-side walls and narrow-side walls delimiting the width of the slab, or billet (page 6, lines 2-16). The cross-section of the mold at the pouring-in-side end is greater than at the billet-exit-side end, or of a descending funnel shape with a hollow cavity becoming smaller in the pouring direction

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(page 4, lines 6-8; and Figure 1). Although Stagge et al. do not teach a surface-related heat flow in the more stressed area of the bath surface that is specifically within the range of 5-40% (or 10-20%) greater than in the other areas of the bath surface, one of ordinary skill in the art would have recognized that the liquid-cooled chill mold of Stagge et al., specifically in the abovementioned mechanically stressed areas of the mold, is capable of a range of cooling parameters in various mold cooling areas that would be readily optimized by one of ordinary skill in the art. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

7. Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Euler et al. (US 4,658,884).

Euler et al. disclose a mold for continuous casting of billets, in which the mold is cooled by water forced through grooves provided in the area of the liquid bath level (meniscus) of the mold with sides in contact with cooling water and molten metal, respectively (abstract; column 4, lines 3-21; and Figures 1-3). Such cooling is advantageous for reducing mold damage, most likely to occur in the most stressed areas (column 1, lines 51-54). Although Euler et al. do not teach a surface-related heat flow in the more stressed area of the bath surface that is specifically within the range of 5-40% (or 10-20%) greater than in the other areas of the bath surface, one of ordinary skill in the art would have recognized that the continuous casting mold of Euler et al., specifically in the meniscus (thermally and mechanically stressed areas of the mold), is

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capable of a range of cooling parameters in various mold cooling areas that would be readily optimized by one of ordinary skill in the art. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

8. Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mallener (US 3,595,302).

Mallener discloses a cooling structure for a continuous casting mold in which cooling mold plates with coolant grooves form a casting mold (die), such that the grooves in the middle and upper portions are closer together and deeper to permit greater heat abstraction through the middle and upper portions, or closer to the meniscus (abstract; column 2, lines 7-11 and 49-75; column 3, lines 1-75; column 4, lines 1-49; and Figures 1-7). A uniform temperature gradient is obtained by the preferential cooling (differential heat flow) of the upper portion of the mold, which is nearest the meniscus (column 1, lines 34-39; and column 3, lines 36-44 and 56-62). Although Mallener does not teach a surface-related heat flow in the more stressed area of the bath surface that is specifically within the range of 5-40% (or 10-20%) greater than in the other areas of the bath surface, one of ordinary skill in the art would have recognized that the cooling structure for a continuous casting mold of Mallener, specifically in the upper portion of the mold (nearest the meniscus, which is a highly stressed area), is capable of a range of cooling parameters in various mold cooling areas that would be readily optimized by one of ordinary skill in the art. It has been held

that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

9. Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Makelainen et al. (GB 2 177 331).

Makelainen et al. disclose a continuous casting mold for billet casting, in which the mold has a plurality of grooves, such that thermal strain in the mold at the boundary of the molten metal (meniscus) is reduced in those regions by changing the heat transfer capacity of the mold (abstract; page 1, lines 22-26, 44-51, and 88-105; and Figures 1-3). Although Makelainen et al. do not teach a surface-related heat flow in the more stressed area of the bath surface that is specifically within the range of 5-40% (or 10-20%) greater than in the other areas of the bath surface, one of ordinary skill in the art would have recognized that the continuous casting mold of Makelainen et al., specifically in the thermally strained regions around the meniscus, is capable of a range of cooling parameters in various mold cooling areas that would be readily optimized by one of ordinary skill in the art. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

10. Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-133940.

JP 59-133940 discloses a mold to cast a steel slab, in which copper plates at the short sides of the mold are capable of changing water cooling power (abstract; and Figures 1-8). Although JP 59-133940 does not teach a surface-related heat flow in the more stressed area of the bath surface that is specifically within the range of 5-40% (or 10-20%) greater than in the other areas of the bath surface, one of ordinary skill in the art would have recognized that the casting mold of JP 59-133940 is capable of a range of cooling parameters in various mold cooling areas that would be readily optimized by one of ordinary skill in the art. One of ordinary skill in the art would recognize that intensification of cooling is most needed in the regions around the meniscus. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

11. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Villanueva et al. (US 5,797,444), Stagge et al. (WO97/43063), Euler et al. (US 4,658,884), Mallener (US 3,595,302), Makelainen et al. (GB 2 177 331), or JP 59-133940, as applied to claim 1 above, and further in view of Klein et al. (US 5,095,970).

Villanueva et al., Stagge et al., Euler et al., Mallener, Makelainen et al., and JP 59-133940 (individually) disclose/suggest all the elements of claim 1 above. None of those references specifically teaches the cooling zone extending at least 20% (or 30-60%) of the length of the meniscus of the broad-side wall.

However, Klein et al. teach a cooling device along the height of the wide side of the mold cavity that extends approximately 55-75% of the height of the wide sides of the walls (column 1, lines 29-34; column 2, lines 67-68; column 3, lines 1-4; and Figures 1-4) for the purpose of uniform cooling of the metal strand product (column 1, lines 24-26).

It would have been obvious to one of ordinary skill in the art at the time the applicant's invention was made to modify the liquid-cooled casting mold assemblies of either Villanueva et al., Stagge et al., Euler et al., Mallener, Makelainen et al., or JP 59-133940, by adding the quantitatively specified cooling device of Klein et al., in order to obtain uniform cooling of the product (Klein et al.; column 1, lines 24-26).

12. Claims 12, 14, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Villanueva et al. (US 5,797,444), Stagge et al. (WO97/43063), Euler et al. (US 4,658,884), Mallener (US 3,595,302), Makelainen et al. (GB 2 177 331), or JP 59-133940, as applied to claim 1 above, and further in view of Nakashima et al. (US 5,207,266).

Villanueva et al., Stagge et al., Euler et al., Mallener, Makelainen et al., and JP 59-133940 (individually) disclose/suggest all the elements of claim 1 above. None of those references specifically teaches narrower configured coolant channels or cooling bore holes running parallel to the pouring direction with spacings of at least 20% less than in the horizontal adjoining areas of the bath surface in the transition area.

However, Nakashima et al. teach narrower configured coolant channels with regard to their spacings and widths (column 1, lines 47-61; column 4, lines 33-63; and

Figures 2, 9, 11-13, and 16). These coolant channels are arranged in a parallel fashion in the thermally stressed area of the mold wall, as shown by the temperature gradients (Figures 11-13 and 16). The spacing of the coolant channels (as defined by the widths w , $1.5w$, and W) are at least 20% less than the horizontal adjoining area(s) of the surface in the transition (cooling) area(s) (Figures 2, 13 and 16). Additional coolant channels (bore holes) of varying widths and angles are situated between the surface coolant channels (Figure 9). The increased number of coolant channels is desired for the purpose of obtaining a more uniform cooling effect (column 1, lines 39-46).

It would have been obvious to one of ordinary skill in the art at the time the applicant's invention was made to modify the liquid-cooled casting mold assemblies of either Villanueva et al., Stagge et al., Euler et al., Mallener, Makelainen et al., or JP 59-133940, with cooling channels of various spacings and widths taught by Nakashima et al., in order to achieve a more uniform cooling effect (Nakashima et al.; column 1, lines 39-46).

Response to Arguments

13. The examiner acknowledges the applicants' amendment (papers #16 and #18) received by the USPTO on April 30, 2002 and June 4, 2002, respectively. The applicants' amendment has overcome the objection to claim 1. The rejections under 35 USC 103(a) have been revised to exclude the Hargassner et al. reference, which was discussed in the interview of April 3, 2002 (paper #15). Claims 1-7, 9-12, 14, and 15 remain under consideration in the application.

14. Applicant's arguments with respect to claims 1-7, 9-12, 14, and 15 have been considered but are moot in view of the new ground(s) of rejection. The examiner will address the merits of the remaining references used in the prior rejections below.

With regard to the Stagge et al. reference, it is noted that the liquid-cooled (copper) mold of Stagge et al. is funnel-shaped and contains areas that are more susceptible to heat and mechanical stresses than in other areas of the mold. This is in contrast to the (earlier) applicants' argument that there exist no such stressed areas for which enhanced cooling is provided in the liquid-cooled mold of Stagge et al. Critically high thermal and mechanical stresses especially exist at the bath level (meniscus region), for which Stagge et al. preferentially arranges a multiplicity of cooling bores. As a result, an increased cooling rate necessarily exists at and near the bath level with respect to other areas of the mold. Along the same lines, the Villanueva et al. and Grove et al. references both teach cooling-optimized areas constituting a region having elevated heat transfer coefficients (enhanced heat transfer regions and differentials). With regard to prior rejections of claims 6 and 7, the applicant has argued against the teachings of either Villanueva et al. or Stagge et al. in combination with Klein et al. However, a differential cooling zone is present in all references. Therefore, it would have been obvious to one of ordinary skill in the art to have combined either the Villanueva et al. or the Stagge et al. reference with the Klein et al. cooling device along the height of the wide side of the mold cavity that extends approximately 55-75% of the height of the wide sides of the walls in order to obtain uniform cooling of the product. A

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meniscus region inherently exists in all continuous casting molds during operation, and would serve as the solid/liquid metal interface (extending to a solidification point) reaching sufficiently downward into the mold to form a region that would readily be recognized as the most critically stressed area within the mold. One of ordinary skill in the art would recognize that cooling is most needed in those interface regions.

Claims 12, 14, and 15 are also rejected under either Villanueva et al. or Stagge et al., and further in view of Nakashima et al. The arguments presented against the content of the Nakashima et al. reference in the (earlier) applicants' amendment relate to the channel spacing, with the applicant citing Figure 14, which appears to have similar spacing, and was not used as an example in the prior office action of June 6, 2001. Figures 2, 9, 11-13, and 16 clearly show that Nakashima et al. include cooling channels of differing spacings and widths, for which the (heat flow differential) teachings of either Villanueva et al. or Stagge et al. provide the basis for a proper obviousness combination with Nakashima et al., as the varying coolant channels would facilitate cooling in the more stressed regions of the mold.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. SU 1 366 282 and DE 41 27 333 are also cited to show related art. EP 0 931 609 is a reference that is a substantial equivalent of the present application, from which a search report cites several references, including ones in the

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new rejections and related art. These references (or their equivalents) not cited in past office actions are thereby cited on the attached PTO-892.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin P. Kerns whose telephone number is (703) 305-3472. The examiner can normally be reached on Monday-Friday from 8:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Dunn can be reached on (703) 308-3318. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-7718 for regular communications and (703) 305-6078 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

KPK

kpk

June 20, 2002


M. ALEXANDRA ELVE
PRIMARY EXAMINER